

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

81 1. (previously presented): A printer control circuit, which is a dedicated printer control hardware circuit disposed between an upper apparatus, which outputs high-resolution raster data for a first image element included in a print image and second low-resolution raster data for a second image element included in the print image, and a printer, the printer control circuit comprising:

a receiver for receiving the high-resolution raster data for the first image element and the low-resolution raster data for the second image element from the upper apparatus via an interface connected to the upper apparatus;

a halftoning circuit for performing a halftone process to convert the high-resolution raster data for the first image element received by the receiver into low-resolution raster data for the first image element; and

an image completion circuit for obtaining low-resolution raster data for a complete print image based on the low-resolution raster data for the second image element received by the receiver and the low-resolution raster data for the first image element transmitted from said halftoning circuit.

2. (original): A printer control circuit according to claim 1, wherein said first image element is an illustration, and said second image element constitutes characters and graphics.

81 3. (original): A printer control circuit according to claim 1 or 2, wherein said high-resolution raster data for said first image element, which are transmitted from said upper apparatus, are expressed using an upper apparatus display color system that differs from a printer display color system that is employed by said printer; wherein said second low-resolution raster data for said second image element, which are transmitted from said upper apparatus, are expressed using said printer display color system; and wherein said halftoning circuit also performs color conversion for said high-resolution raster data for said first image element that are transmitted from said upper apparatus display color system to said printer display color system.

4. (original): A printer control circuit according to claim 1, wherein for said low-resolution raster data for said complete print image said image completion circuit changes pixel order for interlaced printing.

5. (original): A printer control apparatus according to claim 1, wherein a memory is provided for said image completion circuit, and wherein to obtain said low-resolution raster data for said complete print image said first low-resolution raster data for said first image element and said second low-resolution raster data for said second image element are superimposed and are written in said memory.

6. (original): A printer control apparatus according to claim 5, wherein, when said image completion circuit is writing one of said first low-resolution raster data for said first image element and said second low-resolution raster data for said second image element, said image completion circuit holds the other of said first and second low-resolution raster image data that are to be written to said memory.

8, 7. (original): A printer control apparatus according to claim 5, wherein said high-resolution raster data for said first image element and said second low-resolution raster data for said second image element are sequentially transmitted by said upper apparatus; and wherein, when said image completion circuit recognizes that raster data both for said first and for said second image elements have been rasterized, said image completion circuit increments a vertical address for designating a location in said memory for writing said raster data, and superimposes and writes, at the same vertical address in said memory, said raster data for said first and said second image elements for the same raster.

8. (original): A printer control apparatus according to claim 7, wherein, for a raster having said first image element or said second element not available, a raster end command for instructing raster termination of a pertinent image element is transmitted by said upper apparatus, and wherein, upon receiving said raster end command, said image completion circuit acknowledges said raster termination of said pertinent image element and obtains the same results without requiring null data for said pertinent image element that is being written in said memory.

9. (original) A printer control apparatus according to claim 5, wherein, in order to develop said low-resolution raster data for said complete print image, said memory has a capacity that is large enough to store all the raster data in a range that is equivalent to one where the print head of said printer covers two paths; and wherein, while said image completion circuit reads raster data stored in said memory that said print head requires for the current path, said image completion circuit writes raster data in said memory until the last raster that said print head requires for the next path is reached.

8, 10. (original): A printer control apparatus according to claim 5, wherein said image completion circuit writes raster data to said memory in an OR write mode; and wherein said image completion circuit reads raster mode from said memory in a clear read mode during the last reading cycle for each raster, and in a normal read mode during a reading cycle other than the last reading cycle.

11. (previously presented): A printer for printing an image including a first image element and a second image element comprising:

a hardware circuit for processing image data including first high-resolution raster data for the first image element and low-resolution raster data for the second image element that are received from an upper apparatus, said hardware circuit including

a distributor which receives the image data from the upper apparatus and distributes the high-resolution raster data to a halftoning circuit and distributes the low-resolution raster data to an image completion circuit;

wherein the halftoning circuit performs halftoning for the high-resolution raster data for the first image element received from the distributor, obtains low-resolution raster data for the first image element, and transmits the obtained low-resolution raster data for the first image element to the image completion circuit; and

8, wherein the image completion circuit obtains low-resolution raster data for a complete print image based on the low-resolution raster data for the first image element received from the halftoning circuit and the low-resolution raster data for the second image element received from the distributor,

wherein printing is performed using said low-resolution raster data that are obtained by said hardware circuit for said complete print image.

12. (original): A printer according to claim 11, wherein said first image element is an illustration, and said second image element constitutes characters and graphics.

13. (original): A printer according to claim 11 or 12, wherein said high-resolution raster data for said first image element, which are transmitted from said upper apparatus, are expressed using an upper apparatus display color system that differs from a printer display color system that is employed by said printer; wherein said second low-resolution raster data for said second image element, which are transmitted from said upper apparatus, are expressed using said printer

display color system; and wherein said halftoning circuit also performs color conversion for said high-resolution raster data for said first image element that are transmitted from said upper apparatus display color system to said printer display color system.

14. (original): A printer according to claim 11, wherein for said low-resolution raster data for said complete print image said image completion circuit changes pixel order for interlaced printing.

Ε 15. (original): A printer according to claim 11, wherein a memory is provided for said image completion circuit, and wherein to obtain said low-resolution raster data for said complete print image said first low-resolution raster data for said first image element and said second low-resolution raster data for said second image element are superimposed and are written in said memory.

16. (original): A printer according to claim 15, wherein, when said image completion circuit is writing one of said first low-resolution raster data for said first image element and said second low-resolution raster data for said second image element, said image completion circuit holds the other of said first and second low-resolution raster image data that are to be written to said memory.

17. (original): A printer according to claim 15, wherein said high-resolution raster data for said first image element and said second low-resolution raster data for said second image

element are sequentially transmitted by said upper apparatus; and wherein, when said image completion circuit recognizes that raster data both for said first and for said second image elements have been rasterized, said image completion circuit increments a vertical address for designating a location in said memory for writing said raster data, and superimposes and writes, at the same vertical address in said memory, said raster data for said first and said second image elements for the same raster.

18. (original): A printer according to claim 17, wherein, for a raster having said first image element or said second element not available, a raster end command for instructing raster termination of a pertinent image element is transmitted by said upper apparatus, and wherein, upon receiving said raster end command, said image completion circuit acknowledges said raster termination of said pertinent image element and obtains the same results without requiring null data for said pertinent image element that is being written in said memory.

19. (original): A printer according to claim 15, wherein, in order to develop said low-resolution raster data for said complete print image, said memory has a capacity that is large enough to store all the raster data in a range that is equivalent to one where the print head of said printer covers two paths; and wherein, while said image completion circuit reads raster data stored in said memory that said print head requires for the current path, said image completion circuit writes raster data in said memory until the last raster that said print head requires for the next path is reached.

20. (original): A printer according to claim 15, wherein said image completion circuit writes raster data to said memory in an OR write mode; and wherein said image completion circuit reads raster mode from said memory in a clear read mode during the last reading cycle for each raster, and in a normal read mode during reading cycle other than the last reading cycle.

21. (previously presented): A printing system comprising:

an image data output unit which outputs an image data including high-resolution raster data for a first image element included in a print image and second low-resolution raster data for which halftoning has been processed for a second image element included in the print image;

81 a hardware circuit for processing an image data including the high-resolution raster data and the low-resolution raster data, the hardware circuit including

a distributor which receives the image data from the image data output unit and distributes the high-resolution raster data to a halftoning circuit and distributes the low-resolution raster data to an image completion circuit,

the halftoning circuit for performing halftoning for the high-resolution raster data for the first image element received from the distributor, obtaining low-resolution raster data for the first image element and transmitting the obtained low-resolution raster data for the first image element to the image completion circuit, and

the image completion circuit for obtaining low-resolution raster data for a complete print image based on the low-resolution raster data for the first image element received from the halftoning circuit and the low-resolution raster data for the second image element received from the distributor; and

a printer for printing an image based on the low-resolution raster data for the complete print image obtained by the hardware circuit.

22. (original): A printing system according to claim 21, wherein said first image element is an illustration, and said second image element constitutes characters and graphics.

23. (original): A printing system according to claim 21 or 22, wherein said high-resolution raster data for said first image element, which are transmitted from said upper apparatus, are expressed using an upper apparatus display color system that differs from a printer display color system that is employed by said printer; wherein said second low-resolution raster data for said second image element, which are transmitted from said upper apparatus, are expressed using said printer display color system; and wherein said halftoning circuit also performs color conversion for said high-resolution raster data for said first image element that are transmitted from said upper apparatus display color system to said printer display color system.

24. (original): A printing system according to claim 21, wherein for said low-resolution raster data for said complete print image said image completion circuit changes pixel order for interlaced printing.

25. (original): A printing system according to claim 21, wherein a memory is provided for said image completion circuit, and wherein to obtain said low-resolution raster data for said

complete print image said first low-resolution raster data for said first image element and said second low-resolution raster data for said second image element are superimposed and are written in said memory.

26. (canceled).

27. (currently amended): An upper apparatus, for a printing system for outputting image data to be printed by a printer, that outputs high-resolution raster data for a first image element included in a print image and low-resolution raster data for which halftoning has been processed for a second image element included in said print image~~An upper apparatus according to claim 26~~, wherein said first image element is an illustration, and said second image element constitutes characters and graphics.

28. (currently amended): An upper apparatus, for a printing system for outputting image data to be printed by a printer, that outputs high-resolution raster data for a first image element included in a print image and low-resolution raster data for which halftoning has been processed for a second image element included in said print image~~An upper apparatus according to claim 26~~, which expresses said high-resolution raster data for said first image element using an upper apparatus display color system that differs from a printer display color system that is employed by said printer, and which expresses said low-resolution raster data for said second image element using said printer display color system.

29. (currently amended): An upper apparatus, for a printing system for outputting image data to be printed by a printer, that outputs high-resolution raster data for a first image element included in a print image and low-resolution raster data for which halftoning has been processed for a second image element included in said print image~~An upper apparatus according to claim 26~~, which sequentially transmits said high-resolution raster image for said first image element and said low-resolution raster data for said second image element, and which, for a raster having said first image element or said second image element not available, transmits a raster end command for instructing raster termination of a pertinent image element.

8, 30. (original): A computer-readable recording medium on which is stored a computer program for use in a computer, said computer constituting an upper apparatus, for a printing system for outputting image data to be printed by a printer, that outputs high-resolution raster data for a first image element included in a print image and low-resolution raster data for which halftoning has been processed for a second image element included in said print image.

31. (previously presented): A printer control circuit according to claim 1, wherein the second low-resolution raster data for the second image element is generated by performing a halftone process in said upper apparatus.

32. (previously presented): A printer according to claim 11, wherein the second low-resolution raster data for the second image element is generated by performing a halftone process in said upper apparatus.

33. (previously presented): A printing system according to claim 21, wherein the second low-resolution raster data for the second image element is generated by performing a halftone process in said upper apparatus.

34. (currently amended): An upper apparatus, for a printing system for outputting image data to be printed by a printer, that outputs high-resolution raster data for a first image element included in a print image and low-resolution raster data for which halftoning has been processed for a second image element included in said print image~~An upper apparatus according to claim 26,~~ wherein the second low-resolution raster data for the second image element is generated by performing a halftone process in said upper apparatus.

35. (previously presented): A computer-readable recording medium according to claim 30, wherein the low-resolution raster data for the second image element is generated by performing a halftone process in the upper apparatus.

36. (previously presented): A printer control circuit of claim 1, further comprising:
an upper apparatus interface for communicating with an upper apparatus; and

a printer interface for communicating with a printer.

37. (previously presented): A printer control circuit of claim 36, further comprising:
a command generation circuit which converts the low-resolution raster data for the complete print image into a printer command which is transmitted to the printer via said printer interface.

38. (previously presented): A printing system of claim 21, wherein said dedicated hardware circuit further includes a printer interface for communicating with the printer.

39. (previously presented): A printing system of claim 38 further comprising:
a command generation circuit which converts the low-resolution raster data for the complete print image into a printer command which is transmitted to the printer via said printer interface.

40. (new): A printer printing an image including a first image element and a second image element comprising:

an interface unit for receiving transmitted data from an upper apparatus,

wherein the transmitted data includes an information representing a data type of itself and at least one of a first high-resolution raster data for the first image element and low-resolution raster data for the second image element;

an analysis unit for analyzing the information and discriminating the data type;

a halftoning unit for halftoning for the high-resolution raster data discriminated by the analysis unit and obtaining low-resolution raster data for the first image element;

an image completion unit for obtaining low-resolution raster data for a complete print image based on the low-resolution raster data halftoned by the halftoning unit and the low-resolution raster data received from the upper apparatus.

41. (new): A printer, comprising:

a receiving circuit that receives transmitted data from an upper apparatus, wherein the transmitted data includes high-resolution raster data for a first image element of an image and first low-resolution raster data for a second image element of the image; and

81 a control circuit, wherein the control circuit performs a halftoning operation for the high-resolution raster data and obtains second low-resolution raster data for the first image element based on the halftoning operation, and

wherein the control circuit obtains low-resolution raster data for the image based on the first low-resolution raster data and the second low-resolution raster data.

42. (new): The printer as claimed in claim 41, wherein the transmitted data further comprises identifying data that identifies a data type of the transmitted data.

43. (new): The printer as claimed in claim 42, wherein the control circuit analyzes the identifying data and determines the data type of the transmitted data based on the identifying data.